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**HONEYWELL  
INFORMATION  
SYSTEMS INC.**

L16-92

TITLE:

No. 43A232500

ENGINEERING PRODUCT SPECIFICATION, PART 1  
H-6000 CONSOLE CHANNEL ADAPTER

Total Pages

40

Page 1

REVISION RECORD

| REVISION<br>LETTER | DATE        | PAGES AFFECTED | APPROVALS         | AUTHORITY |
|--------------------|-------------|----------------|-------------------|-----------|
| A ISSUED           | NOV 10 1971 | SH. 1 - 4 OF   | PHD <i>E. Let</i> | EWA12967  |

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HONEYWELL INFORMATION SYSTEMS INC.  
PHOENIX COMPUTER OPERATIONS

NUMBER: 43A232500

A

Cont. on Sh. 4 Sh. No. 3

|                                          | <u>Page</u> |
|------------------------------------------|-------------|
| 4.0 CONSOLE INTERFACE                    | 28          |
| 4.1 Operating Modes                      | 28          |
| 4.2 Instructions                         | 28          |
| 4.2.1 READ                               | 29          |
| 4.2.2 WRITE                              | 30          |
| 4.2.3 Write Alert                        | 31          |
| 4.2.4 Request Status                     | 31          |
| 4.2.5 Reset Status                       | 32          |
| 4.2.6 ASCII Write                        | 33          |
| 4.2.7 T&D Read                           | 33          |
| 4.3 Data Transfer                        | 34          |
| 4.4 Special Interrupt (Operator Request) | 35          |
| 4.5 Status                               | 35          |
| 4.5.1 Channel Ready                      | 35          |
| 4.5.2 Device Attention                   | 36          |
| 4.5.3 Data Alert                         | 36          |
| 4.5.4 Command Reject                     | 37          |
| 5.0 GENERAL DESIGN REQUIREMENTS          | 39          |
| 6.0 RELIABILITY                          | 39          |
| 6.1 Maintainability                      | 39          |



## 1.0 GENERAL DESCRIPTION

The H-6000 Console Channel Adapter will provide interfaces to the H-6000 System Console and to the Input/Output Multiplexer (IOM). This EPS-I defines the requirements placed on the channel adapter to bring about appropriate interaction between the two interfaces.

The channel receives instructions in a Peripheral Control Word (PCW) or in an Instruction Data Control Word (IDCW) from the IOM Central. The channel interprets these control words and provides the interaction required to accomplish the specified I/O transactions. After initiation through receipt of a PCW, the channel will generate the necessary List, Status, Interrupt and Indirect Data Service requests to the IOM which are necessary to perform the functions of executing the DCW list in core. A description of a typical sequence of such services by the IOM Central and the Console Channel Adapter is contained in Section 2.5.

## 1.1 INTERFACE REQUIREMENTS

The Channel Adapter will interface with the communicating display devices of the System Control Center and Auxiliary Consoles as defined in the H-6000 System Control Center EPS-I, 43A232499 and with the IOM Bus as defined in the 655 IOM Central EPS-I, 43A219604.

## 1.2 COMPATIBILITY REQUIREMENTS

No portion of the design of the Console Channel Adapter shall require the rework of an existing User Program. It is a requirement that the channel be designed so that the present H-6000 Common Peripheral Console software can be utilized. That is, the design objective of the channel adapter is to make the CRT console appear to the operating system as a 635 Common Peripheral Console, but provide the flexibility that will allow the operating system to better utilize the characteristics of the CRT display device.

## 1.3 PACKAGING REQUIREMENTS

The Console Channel Adapter will plug into the IOM and interface directly to the IOM Bus. The interface to the console will be capable of driving up to a 150 foot, twisted pair cable.

It is required that the Console Channel Adapter reside on one H-6000 type logic board. The channel adapter is required to be cognizant of one console device. The slave monitors and hard copy monitors will interface with a display device and will be invisible to the channel. The operator interactive display, resource monitor display and auxiliary consoles will interface with identical, but independent channel adapters.



## 1.4 APPLICABLE DOCUMENTS

|                                         |           |
|-----------------------------------------|-----------|
| IOM Common Peripheral Channel           | 43A219605 |
| IOM Central EPS-I                       | 43A219604 |
| H-6000 System Control Center            | 43A232499 |
| General Design Requirements for 655/355 | 43A177851 |
| General Purpose Terminal GPT 350        | 59A200568 |

2.0 FUNCTIONAL CAPABILITIES

The Console Channel Adapter shall provide the functions necessary to bring about the communications between the IOM Central and the system console. The functions to be performed by the channel adapter shall include the following:

- (1) Provide the 36 bit word interface to the IOM.
- (2) Interpret and validate PCW's and DCW's.
- (3) Code conversion from the 635 6-bit to ANSCII 7-bit code.
- (4) device command recognition.
- (5) Control transmit/receive mode of the console devices.
- (6) Provide bit serial interface to the console devices.
- (7) Perform status mapping and interrupt service to the IOM.
- (8) Provide means for system initialize and bootload from the system control center.

## 2.1 OPERATING RATES

The maximum (burst) data transfer rate to the System Control Center will be 960 characters per second and a sustained data transfer rate of 900 characters per second. Transfer to/from the IOM will be single precision (36 bit words).

## 2.2 CHECKING FEATURES

As a link in the hardware of data transfers between core storage and the console the channel adapter will provide parity generation and checking between the console and the IOM. Other fault and failures of hardware, software, and user programs are described in Sections 3.6 and 3.7.

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Rev. A

Page 6

## 2.3 INITIALIZE AND BOOTLOAD

The channel adapter must interface the initialize and bootload signals originating at the system console, and pass these signals to the IOM Central. The channel adapter is not required to process, acknowledge or in any way recognize these signals.

## 2.4 CHARACTER DEFINITION

The interface with the IOM Central will be a 36-bit word interface where all data and command communications may be the 635 six bit character code. The console interface will be a bit serial interface using a seven bit character code. It is a requirement that the channel adapter provide the code conversion capability to bring about the communications between the two interfaces. The capability shall be provided that will enable the software to transfer data to the console without code conversion (see Section 4.2). The characters and code definition of the two schemes are shown in Table 1, and Table 2 respectively.



**Honeywell**

Rev. A

Page 7

TABLE 1  
SIX TO SEVEN BIT CODE CONVERSION

| 6-Bit<br>Octal<br>code | CHARACTER |       | 7-Bit<br>Octal<br>Code |
|------------------------|-----------|-------|------------------------|
|                        | 6-bit     | 7-bit |                        |
| 00                     | 0         |       | 60                     |
| 01                     | 1         |       | 61                     |
| 02                     | 2         |       | 62                     |
| 03                     | 3         |       | 63                     |
| 04                     | 4         |       | 64                     |
| 05                     | 5         |       | 65                     |
| 06                     | 6         |       | 66                     |
| 07                     | 7         |       | 67                     |
| 10                     | 8         |       | 70                     |
| 11                     | 9         |       | 71                     |
| 12                     | [         |       | 133                    |
| 13                     | #         |       | 43                     |
| 14                     | @         |       | 100                    |
| 15                     | :         |       | 72                     |
| 16                     | >         |       | 76                     |
| 17                     | *         |       | 77                     |
| 20                     | *         | SP    | 40                     |
| 21                     | A         |       | 101                    |
| 22                     | B         |       | 102                    |
| 23                     | C         |       | 103                    |
| 24                     | D         |       | 104                    |
| 25                     | E         |       | 105                    |
| 26                     | F         |       | 106                    |
| 27                     | G         |       | 107                    |
| 30                     | H         |       | 110                    |
| 31                     | I         |       | 111                    |
| 32                     | &         |       | 46                     |
| 33                     | .         |       | 56                     |
| 34                     | ]         |       | 135                    |
| 35                     | (         |       | 50                     |
| 36                     | <         |       | 74                     |
| 37                     | /         |       | 134                    |
| 40                     | ↑         | ^     | 136                    |
| 41                     | J         |       | 112                    |
| 42                     | K         |       | 113                    |
| 43                     | L         |       | 114                    |
| 44                     | M         |       | 115                    |
| 45                     | N         |       | 116                    |
| 46                     | O         |       | 117                    |
| 47                     | P         |       | 120                    |
| 50                     | Q         |       | 121                    |
| 51                     | R         |       | 122                    |
| 52                     | -         |       | 55                     |
| 53                     | \$        |       | 44                     |
| 54                     | *         |       | 52                     |
| 55                     | )         |       | 51                     |
| 56                     | ;         |       | 73                     |
| 57                     | !         |       | 47                     |
| 60                     | +         |       | 53                     |
| 61                     | /         |       | 57                     |

TABLE 1 (cont)

| 6-Bit<br>Octal<br>Code | CHARACTER |       | 7-Bit<br>Octal<br>Code |
|------------------------|-----------|-------|------------------------|
|                        | 6-bit     | 7-bit |                        |
| 62                     | S         |       | 123                    |
| 63                     | T         |       | 124                    |
| 64                     | U         |       | 125                    |
| 65                     | V         |       | 126                    |
| 66                     | W         |       | 127                    |
| 67                     | X         |       | 130                    |
| 70                     | Y         |       | 131                    |
| 71                     | Z         |       | 132                    |
| 72                     | ←         | ---   | 137                    |
| 73                     | ,         |       | 54                     |
| 74                     | %         |       | 45                     |
| 75                     | =         |       | 75                     |
| 76                     | "         |       | 42                     |
| 77                     | *         | !     | 41                     |

\* Special Characters, not a direct conversion

The 7-bit symbol is the same as the 6-bit symbol except where 7-bit symbol is shown.



TABLE 2  
Seven Bit to Six Bit Code Conversion

| 7-Bit<br>Octal<br>Code | Character | 6-Bit<br>Octal<br>Code |
|------------------------|-----------|------------------------|
| 7-Bit                  | 6-Bit     |                        |
| 000                    | NULL      |                        |
| 001                    |           |                        |
| 002                    |           |                        |
| 003                    |           |                        |
| 004                    |           |                        |
| 005                    |           |                        |
| 006                    |           |                        |
| 007                    | BELL      |                        |
| 010                    | BS        |                        |
| 011                    | HT        |                        |
| 012                    | LF        |                        |
| 013                    |           |                        |
| 014                    | FF        |                        |
| 015                    | CR        |                        |
| 016                    |           |                        |
| 017                    |           |                        |
| 020                    | NONE      | NO 6-BIT<br>EQUIVALENT |
| 021                    |           |                        |
| 022                    |           |                        |
| 023                    |           |                        |
| 024                    |           |                        |
| 025                    |           |                        |
| 026                    |           |                        |
| 027                    |           |                        |
| 030                    |           |                        |
| 031                    |           |                        |
| 032                    |           |                        |
| 033                    | ESC       |                        |
| 034                    |           |                        |
| 035                    |           |                        |
| 036                    |           |                        |
| 037                    | US        |                        |
| 040                    | SPACE     | 20                     |
| 041                    | !         | 77                     |
| 042                    | "         | 76                     |
| 043                    | #         | 13                     |
| 044                    | \$        | 53                     |
| 045                    | %         | 74                     |
| 046                    | &         | 32                     |
| 047                    | '         | 57                     |
| 050                    | (         | 35                     |
| 051                    | )         | 55                     |
| 052                    | *         | 54                     |
| 053                    | +         | 60                     |
| 054                    | ,         | 73                     |
| 055                    | -         | 52                     |
| 056                    | .         | 33                     |

TABLE 2 (cont'd)

| 7-Bit<br>Octal<br>Code | Character |       | 6-Bit<br>Octal<br>Code |
|------------------------|-----------|-------|------------------------|
|                        | 7-Bit     | 6-Bit |                        |
| 057                    | /         | /     | 61                     |
| 060                    | 0         | 0     | 00                     |
| 061                    | 1         | 1     | 01                     |
| 062                    | 2         | 2     | 02                     |
| 063                    | 3         | 3     | 03                     |
| 064                    | 4         | 4     | 04                     |
| 065                    | 5         | 5     | 05                     |
| 066                    | 6         | 6     | 06                     |
| 067                    | 7         | 7     | 07                     |
| 070                    | 8         | 8     | 10                     |
| 071                    | 9         | 9     | 11                     |
| 072                    | :         | :     | 15                     |
| 073                    | ;         | ;     | 56                     |
| 074                    | <         | <     | 36                     |
| 075                    | =         | =     | 75                     |
| 076                    | >         | >     | 16                     |
| 077                    | ?         | ?     | 17                     |
| 100                    | @         | @     | 14                     |
| 101 or 104             | A         | A     | 21                     |
| 102 or 142             | B         | B     | 22                     |
| 103 or 143             | C         | C     | 23                     |
| 104 or 144             | D         | D     | 24                     |
| 105 or 145             | E         | E     | 25                     |
| 106 or 146             | F         | F     | 26                     |
| 107 or 147             | G         | G     | 27                     |
| 110 or 150             | H         | H     | 30                     |
| 111 or 151             | I         | I     | 31                     |
| 112 or 152             | J         | J     | 41                     |
| 113 or 153             | K         | K     | 42                     |
| 114 or 154             | L         | L     | 43                     |
| 115 or 155             | M         | M     | 44                     |
| 116 or 156             | N         | N     | 45                     |
| 117 or 157             | O         | O     | 46                     |
| 120 or 160             | P         | P     | 47                     |
| 121 or 161             | Q         | Q     | 50                     |
| 122 or 162             | R         | R     | 51                     |
| 123 or 163             | S         | S     | 62                     |
| 124 or 164             | T         | T     | 63                     |
| 125 or 165             | U         | U     | 64                     |
| 126 or 166             | V         | V     | 65                     |
| 127 or 167             | W         | W     | 66                     |
| 130 or 170             | X         | X     | 67                     |
| 131 or 171             | Y         | Y     | 70                     |
| 132 or 172             | Z         | Z     | 71                     |



TABLE 2 (cont'd)

| 7-Bit<br>Octal<br>Code | Character |       | 6-Bit<br>Octal<br>Code        |
|------------------------|-----------|-------|-------------------------------|
|                        | 7-Bit     | 6-Bit |                               |
| 133                    | C         | C     | 12                            |
| 134                    | \         | \     | 37                            |
| 135                    | J         | J     | 34                            |
| 136                    | ^         | ↑     | 40                            |
| 137                    | —         | ←     | 72                            |
| 140                    |           |       | { NO EQUIVALENT<br>6-BIT CODE |
| 173-177                |           |       |                               |

## 2.4.1

Special Characters

As noted in Table 1 the H-6000 internal 6-Bit code contains three special characters. It is required that the channel adapter detect and interpret the occurrence of special characters in the data stream to the console. The special characters and sequences to be interpreted by the channel are defined in the following paragraphs.

Escape Character - The escape character is an octal 77. The escape character requires the interpretation of one or more following characters. If three escape characters are received, not separated by a normal character, an exclamation point (octal 77) will be transmitted to the console.

If one escape character is received followed by a character with a '0' in the high-order bit position, a line feed and carriage return will be transmitted to the console.

If one escape character is received followed by a character with a '1' in the high-order bit position and a '0' in the next bit position, the tabulate character will be transmitted to the console.

Ignore Character - The ignore character is a question mark, octal 17. If an ignore character is preceded by two escape characters a question mark will be transmitted to the console. If two escape characters do not precede the ignore character, then the ignore character is simply ignored and nothing happens.

Space Character - If a space character is received with no preceding escape characters the channel transmits a space to the console. If the space character is preceded by two escape characters the channel will transmit an End of Message Character ( ) to the console.

A summary of the special character sequences follows:

- 77 followed by 77 followed by 77 = !
- 77 followed by 77 followed by 17 = ?
- 77 followed by 77 followed by 20 = \_ (end of message character)
- 77 followed by 0xxxxx = carriage return and line feed
- 77 followed by 10xxxx = horizontal tab

It is to be noted that the special characters (!, ?, space) received from the console will not be interpreted, but will be converted to the respective 6-bit code as shown in Table 2. Also, if the system chooses to transmit data to the console in the ASCII format, no escape sequences will be interpreted.



2.4.2 Illegal Formats

The following escape sequences are illegal and upon detection will be terminate with Data Alert, Major Status, Illegal Format Substatus:

77 followed by 77 followed by any character other  
than 20, 17, or 77.  
77 followed by 11xxxx unless xxxx = 1111

2.4.3 ASCII Code

The ASCII codes from 000 through octal 037 have no 6-bit equivalent and when received from the console by the channel these codes will be ignored. The ASCII codes octal 141 through octal 172 will be interpreted as octal 101 through octal 132 respectively.

If the software desires to transfer the ASCII code to the console directly (no conversion in the channel) this can be accomplished by specifying an ASCII Write, as defined in Section 4.0. In this case the functions assigned to the 7-bit codes in the range from 000 to octal 037 are listed in Table 2. The codes with no function assigns will be ignored by the console. Additional functions can be executed when the ASCII Write option is chosen by using an ESC sequence. The ASCII ESC sequences are interpreted and executed by the console and are listed here for reference.

| <u>ESCAPE<br/>SEQUENCE</u> | <u>CONTROL<br/>FUNCTION</u> |
|----------------------------|-----------------------------|
| ESC C                      | FORWARD SPACE               |
| ESC 7                      | REVERSE LINE FEED           |
| ESC B                      | HOME UP                     |
| ESC 1                      | TAB SET                     |
| ESC 2                      | TAB CLEAR                   |

## 2.5 DESCRIPTION OF OPERATION

The following paragraphs describe, in general, a typical operation of the IOM Central with the Console Channel Adapter so that the reader might envision the overall operation. The description is not intended to be detailed, and assumes that the reader is familiar with the functions performed by the IOM Central.

The software must prepare several control words, in addition to a buffer area for data to be transferred. Data Control Words (DCW) indicating the location of each data area must be placed in a DCW list. A List Pointer Word (LPW) indicating the location of the DCW list must then be placed in the LPW mailbox for the desired data channel.



## 2.5 DESCRIPTION OF OPERATION (continued)

For the purpose of this discussion, assume that the console channel adapter is to be issued an instruction to transfer data to the system console. A Status Control Word (SCW) placed in the channels SCW mailbox points to an area of core set aside to receive the status word resulting from the execution of the instruction. A Peripheral Control Word (PCW) containing the console instruction code is placed in another area of core, with a second word containing the channel number of the channel that is to receive the PCW. The LPW mailbox for the connect channel provides a pointer to a list of PCW's to be executed.

Operation in the IOM begins with the receipt of a \$CON from a system controller, issued as a result of a connect instruction. The \$CON causes the connect channel to request the IOM to perform a List Service. The IOM fetches an LPW from the connect channel mailbox to obtain the PCW. The connect channel LPW is updated and replaced in core after the channel has been given its PCW. The channel, which is here assumed to be receptive, stores the PCW from the IOM and initiates communication with the system console.

When the channel has determined that the console is receptive to the instruction, the channel will request the IOM to perform a list service.

The IOM upon receiving this request will fetch the LPW from the requesting channel's mailbox. The LPW points the IOM to a specific DCW within the DCW list. The DCW is checked for several conditions, placed in the channel mailbox and transmitted to the channel. The IOM then updates the LPW and stores it in the data channel's mailbox. The channel now requests a data service of the IOM, specifying an indirect data load. The IOM uses the DCW from the mailbox of the requesting channel to obtain the first word from the data buffer. The address and tally fields are updated and the DCW is returned to the mailbox of the data channel. The data is transferred to the channel. This indirect data service is repeated until (1) an abnormal condition is detected by the channel or, (2) all DCW's in the list including the final IOTD type DCW are exhausted.

Anything which causes the termination of the operation with the Console will cause the channel to request the IOM to do a status service. Using the Status Control Word for the channel, the IOM will store status in the status Queue indicated by the SCW, update the SCW and restore it to the channel mailbox.

Following the status service, the channel will request the IOM to do a Multiplex Interrupt Service. Using a combination of configuration switches and interrupt level indications in the service request, the IOM will retrieve one of 32 Interrupt Multiplex Words, set a bit to indicate which channel is causing the interrupt, and restore the word, then finally set the corresponding interrupt cell in the system controller. This will inform the software that the sequence of operations is concluded.



## 3.0

IOM INTERFACE

Two methods of establishing communications are used between the IOM Central and the channel. (1) A PCW is issued to the channel by the IOM as a result of a connect instruction. (2) A request for service specifying the type of service required is received by the IOM from the channel.

## 3.1

CHANNEL NUMBER

The channel is required to provide facilities for configuring a unique 6-bit channel number which will distinguish the channel from all other channels connected to the same IOM. This channel number is used for two purposes: (1) for recognizing Peripheral Control Words (PCW's) intended for the channel; and (2) for identifying itself when requesting services from the IOM Central. The same physical circuit must be used for defining the channel number for both the above functions.

## 3.2

DCW LIST

The Data Control Word (DCW) list consists of a sequence of Instruction DCW's, and/or data DCW's. The format for the DCW indicating how each type is specified is given in Section 3.4.1.

DCW's in the list are processed sequentially and the channel can go to a new DCW (List service) when an old DCW tally exhausts and the PCW/IDCW calls for continuation or the current DCW is an IOTP and the pre-tally runout condition occurs. This processing is shown in the flow chart on the following page.

If the PCW/IDCW has a data transfer instruction, the first or next DCW must be a data DCW: IOTP, or IOTD. These are, respectively, I/O Transfer and Proceed, and I/O Transfer and Disconnect. One or more IOTP's must be followed by an IOTD, before the occurrence of an IDCW. The IDCW is the only allowable DCW following an IOTD, if the PCW/IDCW indicated the list should continue.

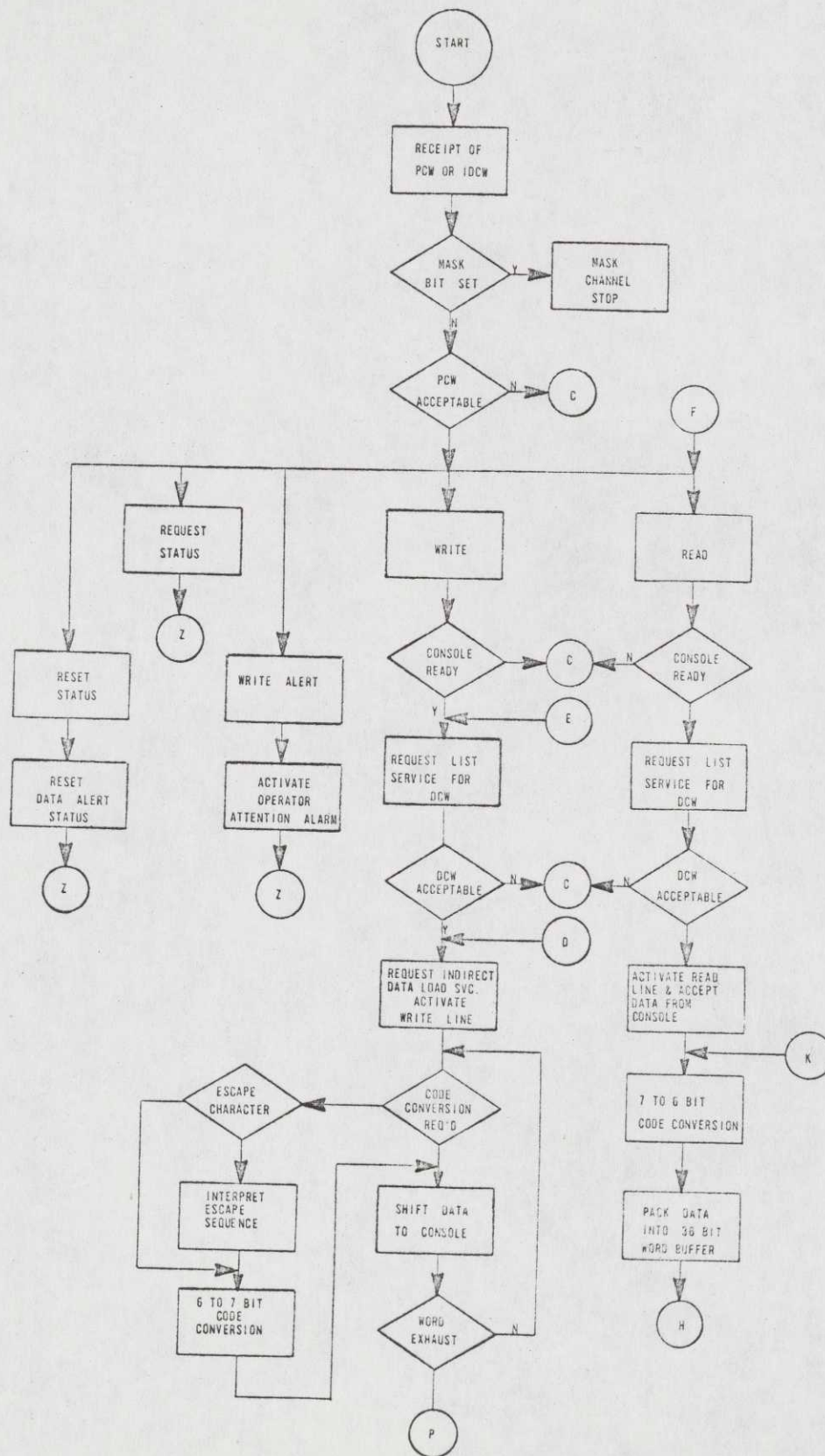
No DCW is required if the PCW or IDCW has a device instruction of Reset Status, Request Status or Write Alert. The continue bit (bit 22) will not be checked when the device instruction is a non-data transfer type instruction.

If at any point in the sequence a status other than Ready occurs, or if the continue bit is not set, or a System or User fault occurs, the use of the list is discontinued, and action stops after the last status is stored and interrupt request granted.

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Rev. A

Cont. on Page 17 Page 16

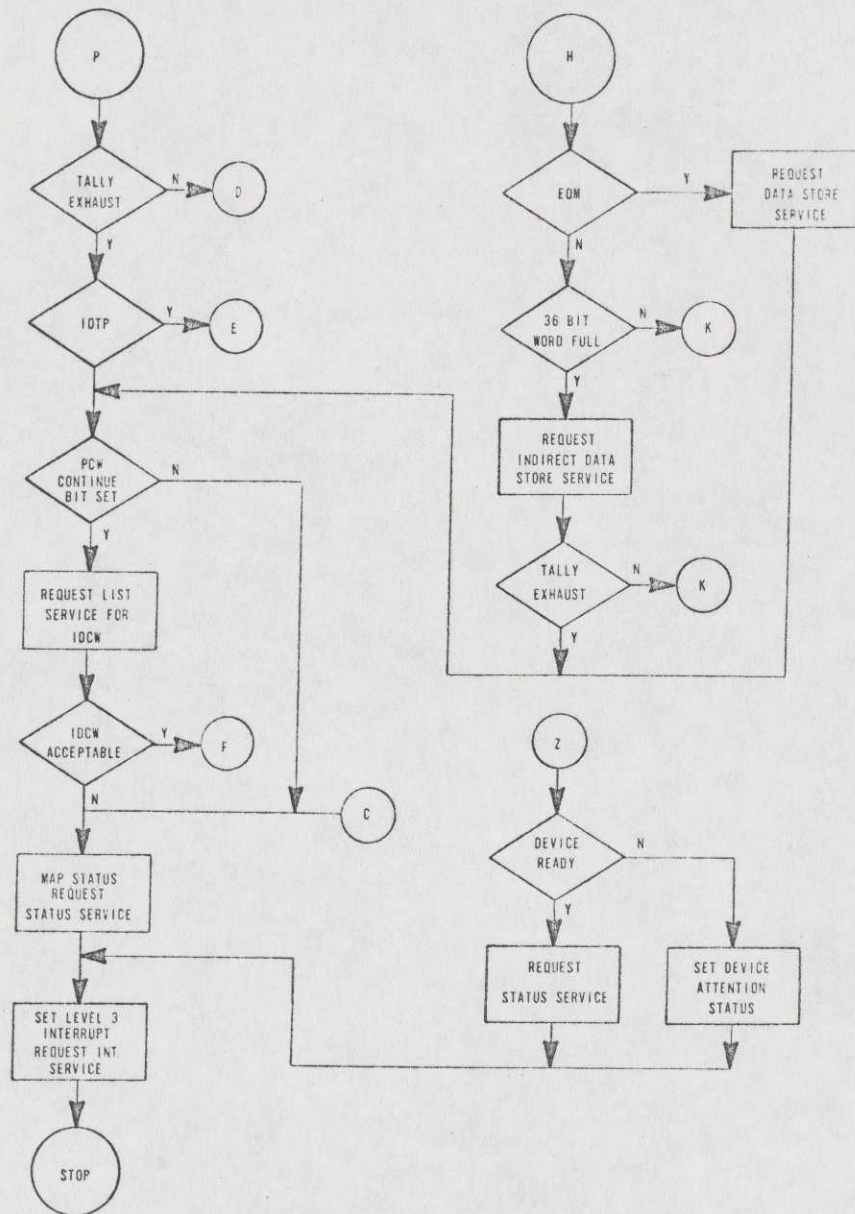




Honeywell

Rev. A

Cont. on Page 18 Page 17



## 3.3

## PERIPHERAL CONTROL WORD (PCW)

Since a PCW directed to a channel may occur at any time, the channel must always be able to respond to this input. If the mask bit (bit 21) in the PCW is not set, and if the channel is not currently busy, the channel will accept and store the PCW, whose format is described below, and initiate the action called for.

If the channel were already busy, the channel will conclude all console operations. When the operation has been terminated, the channel will store Terminate status and perform a Program Interrupt. However, if the mask bit in the PCW is set, (bit 21), then any existing operation is concluded, and all communication with IOM Central is disallowed until another PCW is received in which bit 21 is zero.

The channel will verify that: (1) no fault condition exists, (2) that the console is ready and (3) that a legitimate device instruction is encoded in the PCW. If any of these conditions fail, the channel will request status and program interrupt service. If these conditions are satisfied, the channel will execute the device instruction. If the device instruction specifies a data transfer operation, and the console is receptive, the channel will request of IOM Central a List Service to obtain a data DCW. Any faults detected during the transaction, will cause the channel to conclude all operations and request a status and interrupt service. If the channel instruction is a non-data transfer operation, no data DCW is required, and a list service request will not be made.

## 3.3.1

PCW Format

The Peripheral Control Word (PCW) and the Instruction DCW (IDCW) both use the same format. The PCW is distinguished by being obtained as the end result of a connect: the IDCW has been conceived to allow the software and unrestricted user programs to place instructions for peripheral devices at appropriate places in a DCW list accessed only by list services. Any distinction, in interpretation of the fields is given in the description of that field.

|                            |                   |       |       |                  |                  |          |
|----------------------------|-------------------|-------|-------|------------------|------------------|----------|
| 0                          | 5 6               | 11 12 | 17 18 | 20               | 21 22 23         | 35       |
| Device<br>Instruc-<br>tion | Device<br>Address | MBZ   | 111   | M<br>A<br>S<br>K | C<br>O<br>N<br>T | NOT USED |

The interpretation of these fields are as follows:

Device Instruction (bits 0-5) - This instruction field is interpreted by the channel to determine what transaction is to be executed. The acceptable instructions that may be contained in this field are defined in Section 4.2.



## 3.3.1

PCW Format (continued)

Device Address (bits 6-11) - The channel adapter interfaces a single console device; therefore, the device address field must be zero.

MBZ (bits 12-17) - These bits are unused and unchecked by the console channel, but must be zero for future compatibility.

Bits 18-20 - This field must be 111 to identify the PCW and distinguish the IDCW from other Data Control Words.

Mask (bit 21) - This bit is ignored in an IDCW. When set to zero in a PCW, the channel responds normally. When set to one in a PCW, the channel will conclude current console operation, and will cease all communication with IOM Central until a PCW with bit 21 = 0 is received.

Continue (bit 22) - This bit, when set, will specify that list service is to continue following successful completion of an IOTD type DCW.

Upon successfully satisfying an IOTD type DCW, with the continue bit set in the PCW, the channel will request another list service for an IDCW without requesting a status or interrupt service. The IDCW could also specify a list continuation, if the preceding PCW specified list continuation.

Not Used (Bits 23-25) - This field is not used and will be checked by the console channel.

## 3.4

## SERVICES

The console channel adapter shall be able to request IOM Central to accomplish the following services:

- o List Service to Proceed (Data DCW)
- o Indirect Data Services (Load and Store)
- o List Service to Continue (Instruction DCW)
- o Program Interrupt Service

The desired IOM service will be specified by the channel by placing the required information on the IOM data input bus.

3.4.1 List Service to Proceed

The channel will request IOM Central to do a List Service for the purpose of obtaining a Data DCW under the following conditions:

- (1) The channel has received and accepted a PCW or an IDCW calling for a data transfer, and
- (2) The channel has either not obtained a data DCW for this instruction, or the current DCW is an IOTP and a pre-tally runout condition occurs.

The channel will request a list service by placing the following information on the data input bus.

| 0        | 20 | 21 | 26 | 27             | 29                   | 30          | 31          | 35 |
|----------|----|----|----|----------------|----------------------|-------------|-------------|----|
| Not used |    |    |    | channel number | service request code | M<br>0<br>D | Not<br>Used |    |

- o Not Used (bits 0-20, 31-35) - These bits will not be used by the console channel adapter when requesting a list service and will be set to zero.
- o Channel Number (bits 21-26) - This field will contain the 6-bit patchable identification number assigned to the console channel.
- o Service Request Code (bits 27-29) - This three bit field will specify the type of service the IOM Central is to perform. For a list service to proceed request this field will contain an octal 1.
- o MOD Field (bit 30) - This bit modifies, or adds significance to the Service Request. When the Service Request is for list service, setting the MOD bit specifies to the IOM that this is the first list request. That is, setting this bit will specify that the list service is initiated as a result of receipt of a PCW.

When the List Service request is honored, IOM Central will place a Data Control Word (DCW) in the channel's mailbox. The first list service following the receipt of the PCW is defined as "First List Service" and the channel is **required** to indicate this fact to IOM Central as part of the request for service.

When a list service is requested, the following conditions may be seen by the channel:

- o A User Fault condition
- o A System Fault condition
- o A data transfer and proceed DCW (IOTP)
- o A data transfer and disconnect DCW (IOTD)



3.4.1 List Service to Proceed (continued)

If the IOTP, and IOTD occur in their expected, power sequence, the channel will proceed with the instruction and request an Indirect Data Service. If an unexpected type of DCW occurs, (such as an IDCW when a previous PCW or IDCW has called for a Read or Write) then a User Fault has occurred, the operation will be concluded and the channel will disconnect with Status and Interrupt service requests. When a System Fault occurs, the channel will go into the masked condition, concluding the console action, without storing status or interrupting. The Fault Channel in IOM Central will handle the System Fault Status.

The DCW is fully described in the IOM Central EPS-I referenced in Section 1.4. This section is intended to define the interpretation of DCW's by the console channel adapter.

The entire DCW obtained by the IOM during a list service is sent as data to the channel coincident with the insertion of the DCW into the mailbox. The channel must determine the type of DCW (IDCW, IOTP, IOTD) and the initial character position. (The transfer DCW is handled by IOM Central, and is not sent to the channel.)

The DCW is formatted as follows:

|         |          |          |        |         |
|---------|----------|----------|--------|---------|
| 0       | 16,17,18 | 20,21,22 | 23,24  | 35      |
| IGNORED | O/E      | CP       | I TYPE | IGNORED |

Ignored (bits 0-16, 21, 24-35) - These bits are all meaningful to the IOM Central, but are ignored in the console channel.

Odd/Even (bit 17) - The least significant bit of the data address normally used with tally information supplied by IOM Central to determine whether a single or double-precision data transfer is requested. The console channel will ignore this bit since all data request will be single-precision.

Character Position (bits 18-20) - These bits are stored from the first DCW and ignored on all others. This field specifies the position of the first character within the first word of the data from the IOM. If the channel encounters a character position value of octal 6, operation will be concluded and a user fault: Character Size/Position discrepancy will be reported in the terminate status. The channel will only report this fault if no IOM Central detected user fault has occurred. The character position field is zeroed by IOM Central when the DCW is placed in the channel mailbox, for use in subsequent data services. The character position indicates the character offset in the first word transferred. It is necessary that the channel have the proper character position prior to initiating data transfer.



3.4.1 List Service to Proceed (continued)

Type (bits 22-23) - This field must be coded to identify the type of DCW as follows:

- 00 IOTD I/O Transfer and Disconnect. The current device instruction is ended (terminated) when the channel detects that the tally has been decremented to zero by the IOM Central.
- 01 IOTP I/O Transfer and Proceed. The current device instruction proceeds to a new DCW when the channel detects the pre-tally runout condition of the tally.

3.4.2 Data Service

Only Single Precision, Indirect Data services (load and store) are requested of IOM Central by the Console Channel Adapter.

The channel will request an indirect data service by placing the following information on the IOM data bus.

|             |    |                   |    |                            |    |             |        |               |    |             |    |
|-------------|----|-------------------|----|----------------------------|----|-------------|--------|---------------|----|-------------|----|
| 0           | 20 | 21                | 26 | 27                         | 29 | 30          | 31     | 32            | 33 | 34          | 35 |
| Not<br>Used |    | Channel<br>Number |    | Service<br>Request<br>Code |    | M<br>O<br>D | D<br>P | Char.<br>Size |    | Not<br>Used |    |

- o Not Used (bits 0-20, 34-35) - These bits are not used for a data request and must be set to zero by the channel.
- o Channel Number (bits 21-26) - This field will contain the 6-bit channel identification number that will identify the channel to the IOM.
- o Service Request Code (bits 27-29) - This field will contain an octal 4 or octal 5, specifying an indirect data load of indirect data store service respectively.
- o MOD (bit 30) - This bit will always be set to '0' for a data service request.
- o DP, Double Precision (bit 31) - This bit will always be set to '0' for a data service request.
- o Character Size (bits 32-33) - This field identifies the character size of the data. These bits will always be '11' to designate 36-bit words.

The sequence of data services may be stopped by an occurrence of a fault condition, or by a tally exhaust found by IOM Central.



**Honeywell**Rev. **A**

Page 23

**3.4.2 Data Service (continued)**

The channel shall interpret the output data and input data on the IOM interface as shown below during the data cycle. The character position codes for the 6-bit characters are shown.

**36-Bit Data Transfer**

|   |     |   |     |    |     |    |     |    |     |    |    |
|---|-----|---|-----|----|-----|----|-----|----|-----|----|----|
| 0 | 5   | 6 | 11  | 12 | 17  | 18 | 23  | 24 | 29  | 30 | 35 |
| M |     |   |     |    |     |    |     |    |     |    | L  |
| S | 000 |   | 001 |    | 010 |    | 011 |    | 100 |    | S  |
| B |     |   |     |    |     |    |     |    |     |    | B  |

The character positions when ASCII code is specified will be as follows:

|   |     |   |     |    |     |    |     |
|---|-----|---|-----|----|-----|----|-----|
| 0 | 8   | 9 | 17  | 18 | 26  | 27 | 35  |
| M |     |   |     |    |     |    | L   |
| S | 000 |   | 001 |    | 010 |    | 011 |
| B |     |   |     |    |     |    | B   |

**3.4.3 List Service to Continue**

The channel will request IOM Central to do a list service for the purpose of obtaining an Instruction DCW under the following conditions:

- (1) The previous PCW or IDCW contained a data transfer device instruction and indicated the DCW list should continue, and
- (2) The preceding DCW was an IOTD, and its tally has exhausted.

The only difference between the list service to proceed request and the list service to continue request is that the MOD bit (bit 30) must be zero for the latter.

Since the IOM Central intercepts Transfer DCW's, an DCW sent to the channel at this time which is not an IDCW will cause a Termination with a User Fault: Incorrect DCW status.

The format of the IDCW is basically the same as the PCW, except that some fields are ignored:

|          |         |   |     |    |     |    |    |    |    |    |    |
|----------|---------|---|-----|----|-----|----|----|----|----|----|----|
| 0        | 5       | 6 | 11  | 12 | 17  | 18 | 20 | 21 | 22 | 23 | 35 |
| DEVICE   |         |   |     |    |     |    |    | I  | C  |    |    |
| INSTRUC- | Device  |   | MBZ |    | 111 |    |    | G  | O  |    |    |
| TION     | Address |   |     |    |     |    |    | N  | N  |    |    |
|          |         |   |     |    |     |    |    | T  |    |    |    |

The interpretation of these fields are as follows:



3.4.3 List Service to Continue (continued)

Device Instruction (bits 0-5) - This field is interpreted by the channel and defines the operation that is to be performed.

Device Address (bits 6-11) - The channel adapter interfaces a single console device. Therefore, the device address must be zero.

Ignored (bit 21) - This bit is ignored in an IDCW, since only a PCW may mask a channel operation.

MBZ (bits 12-17) - These bits are unused and unchecked, but must be zero for future compatibility.

Bits 18-20 - Must be 111 to distinguish an IDCW from other Data Control words.

Continue (bit 22) - This bit is interpreted the same as in the PCW and is described in Section 3.4.1.

Not Used (bits 23-35) - This field is not used and not checked by the console channel.

3.4.4 Status Service (Termination)

Termination status is stored by requesting a Status Service and presenting the IOM Central the status word in the format shown below. Termination status is stored whenever any User Fault or console status of not - ready occurs, or whenever a PCW or DCW is terminated which does not indicate that continuation of the DCW list is desired. Terminate Status storage must always be followed by an Interrupt service request, level 3.

The channel will request a status service by placing the following information of the IOM data bus.

| 0             | 2 | 3 | 4           | 20 | 21                | 26 | 27                 | 29 | 30          | 35 |
|---------------|---|---|-------------|----|-------------------|----|--------------------|----|-------------|----|
| Char.<br>pos. | R | e | Not<br>Used |    | Channel<br>Number |    | Service<br>Request |    | Not<br>Used |    |
|               | a | d |             |    |                   |    |                    |    |             |    |

Character Position and Read Field (bits 0-3) - The Console Channel will return the character position residue and a Read/Write indication to the IOM as part of the Service Request to IOM Central. The Character Position residue is the character number into which or from which the next data character would have been transmitted if the transaction had continued. The channels will always transfer 36-bit words on the IOM interface, and will indicate the last actual character +1 that was transmitted/received as the character position residue. The channel will similarly indicate whether data transfer was to satisfy a Read or a Write operation, by indicating a one for a Read in bit 3.



3.4.4

Status Service (Termination) (continued)

Not Used bits 4-20, 30-35) - These fields are not used for a status service request and must be set to zero.

Channel Number (bits 21-26) - This field will contain the channel identification number.

Service Request Code (bits 27-29) - This field will contain octal 02, identifying the request for a status service.

The channel must recognize user faults reported to it by IOM Central, and store this together with the subsystem status, as shown in the description of the status word as follows:

| 0 | 1 | 2            | 5 | 6 | 11        | 12 | 15              | 16 | 17 | 18 | 23               | 24 | 35  |
|---|---|--------------|---|---|-----------|----|-----------------|----|----|----|------------------|----|-----|
| T | P | MAJOR STATUS |   |   | SUBSTATUS |    | SOFTWARE STATUS |    | I  | A  | IOM/CHAN. STATUS |    | MBZ |

The status word format generated by the channel will be compatible with the IOC-C format. The content of the IOM/Channel Status field is encoded differently. The fields have the following definitions:

Entry Present Bit (0) - Stored as a one by the channel hardware; software presently resets this bit to zero to indicate that the status has been examined.

Power Bit (1) - A one if the console does not have its power on, or if there is no console attached.

Major and Substatus (bits 2-11) - The subsystem status will be mapped by the channel adapter. The status codes that are to be reported to the IOM are defined in Section 4.5.

Software Status (bits 12-15) - Stored as zero by the channel hardware; is presently used by GECOS to indicate software detected errors to the slave program after the hardware has stored the status word.

Initiation Interrupt (bit 16) - A one if the console device is not receptive to the command.

Abort Bit (bit 17) - Stored as zero by the channel hardware. It is set to one by software if this transaction caused the program to be aborted.

IOM/Channel Status (bits 18-35) - The IOM Status field is divided into 2 independent 3-bit segments; bits 18-20 represent channel detected User Faults and bits 21-23 represent IOM Central detected User Faults reported to the channel. The faults and their codes are described in Section 3.6.

MBZ (bits 24-35) - Unused at present; must be zero (MBZ).



3 4 5

Program Interrupt Service

The console channel is restricted to two of the eight interrupt levels available in the IOM Central. These levels are specified as part of the Interrupt Service request, and are:

- (1) Level 7: Special Interrupt
- (2) Level 3: Terminate Interrupt

The channel will request an interrupt service by placing the following information on the IOM data bus.

|             |                          |             |       |                   |                            |             |    |
|-------------|--------------------------|-------------|-------|-------------------|----------------------------|-------------|----|
| 0           | 12 13                    | 15 16       | 17 18 | 20 21             | 26 27                      | 29 30       | 35 |
| Not<br>Used | Prog.<br>Inter.<br>Level | Not<br>Used |       | Channel<br>Number | Service<br>Request<br>Code | Not<br>Used |    |

Not Used (bits 0-12, 16-20, 30-35) - These fields are not used for an interrupt service request and must be set to zero by the channel.

Program Interrupt Level (bits 13-15) - This field identifies the type of interrupt to be serviced. The valid codes in this field will be an octal 7 for a Special Interrupt or an octal 3 for a Terminate Interrupt.

Channel Number (bits 21-26) - This field will specify the service being requested, in this case the code will be octal 3, specifying an program interrupt.

Terminate interrupts always follow the respective status storage service following the termination of a command.

The special interrupt is initiated by the operator from the control center. There is no associated status storage with a special interrupt request. The execution of the special interrupt is defined in Section 4.4..

3.5

USER FAULTS

User faults are defined as faults caused by user or slave programs operating under GECOS. Because of their nature or timing relationship, certain hardware malfunctions also must be reported as user faults.

The console channel must recognize the user fault indications from the IOM and those detected by the channel, and on their occurrence must conclude any operation in progress, leaving the channel unmasked. The channel must go through its normal termination procedure; i.e., store status with the appropriate user fault code and program interrupt with a terminate interrupt. Thus, user faults will be indicated in the status queue that is normally used by the console channel.



## 3.5.1

IOM Central Detected User Faults

When the IOM Central detects a User Fault, it will indicate a fault and the fault type to the channel at the end of the service. The IOM detected user faults are reported in bits 21-23 of the Status Word. The faults and their codes are as follows:

| <u>Code</u><br><u>21,22,23</u> | <u>Fault</u>                                                                                   |
|--------------------------------|------------------------------------------------------------------------------------------------|
| 000                            | None                                                                                           |
| 001                            | LPW tally run-out (not connect channel)                                                        |
| 010                            | 2 TDCW's in succession                                                                         |
| 011                            | Boundary error                                                                                 |
| 100                            | None                                                                                           |
| 101                            | IDCW in restricted mode                                                                        |
| 110                            | Character Position/size discrepancy, list service<br>(detected by the console channel adapter) |
| 111                            | Parity error, I/O bus, data from channel                                                       |

All of the IOM Central detected faults are defined in the IOM Central EPS-I. The console channel, being a word channel to the IOM Central, must detect a character position code of 110 as being a fault. If no other IOM Central detected fault is indicated, the channel will encode 110 into the Central detected fault field, bits 21-23.

## 3.5.2

Channel Detected User Faults

Channel detected user faults are as follows: (Code is in Status Word bits 18-20)

| <u>Code</u><br><u>18,19,20</u> | <u>Fault</u>                                                                          |
|--------------------------------|---------------------------------------------------------------------------------------|
| 000                            | None                                                                                  |
| 001                            | Unexpected PCW (received while channel busy)                                          |
| 010                            | None                                                                                  |
| 011                            | Incorrect DCW, list service (such as no data DCW following an IDCW for Read or Write) |
| 100                            | Console is not receptive to the instruction                                           |
| 101                            | None                                                                                  |
| 110                            | Console Parity Error                                                                  |
| 111                            | Parity error, I/O bus, data to channel from IOM Central                               |

## 3.6

## SYSTEM FAULTS

A System Fault is an improper operation caused either by the hardware or by System software not by user programs.

The channel does not report on system faults. When IOM Central detects a system fault, an indication is sent to the involved channel. The channels will go into a masked condition on this indication, concluding any current operation, and disallowing any communication with IOM Central until a new



## 3.6 SYSTEM FAULTS (continued)

PCW is received. In the meantime, the faults is reported by the fault channel in IOM Central in a separate queue used only for usch faults. The system faults listed below are described in the IOM Central EPS-I.

The System Faults are:

- o Illegal Channel Number
- o Illegal Service Request
- o Parity error, scratchpad read
- o 256K Overflow
- o LPW Tally run-out, connect channel
- o Control word not PCW, connect channel
- o Character Position all ones, data service
- o Character Position/Size discrepancy, data service
- o No System Controller Response
- o Parity error, Core Store Read
- o Tally Control Error

4.0 CONSOLE INTERFACE

The console channel adapter shall provide the communication interface to the system console as defined in EPS-I, 43A232499.

The paragraphs of this section will define the functions and interpretation required of the channel adapter in communicating with the console device.

## 4.1 OPERATING MODES

The channel adapter shall control the operating modes of the console. The normal or ready state of the console is indicated to the channel by the console Ready line and bit clock line. Before the console can transmit data to the channel it is required that the channel place the console in the transmit mode by activating the Read line. When the channel is required to transmit data to the console the console must be placed in the receive mode by activating the channel Write line. After the console has been placed in the transmit or receive mode by the channel adapter the console will control the data transfer rate. That is, the console will generate a character sync. and bit sync. for the data transfer in both directions.

## 4.2 INSTRUCTIONS

This section defines the functional requirements of the instructions that will be executed by the console channel. The instruction code will be communicated to the channel in bits 0-5 of the PCW or IDCW. Any code not defined in this section will result in a termination status of Command Reject, Invalid operation code. The instructions and their execution are defined in the following paragraphs.



## 4.2.1

## READ (03)

If the PCW is acceptable, the channel will verify that the console is ready. If the console is ready, the channel will activate the Read Line. Activation of the Read Line will result in the operator's keyboard being enabled at the console, and the operator's Request Line being inhibited at the channel adapter. Following activation of the Read Line the channel awaits the character sync., and data from the console. As the channel receives data, checks parity and converts the character code to the 6000 internal 6-bit code the data must be assembled into thirty-six bits words. As a thirty-six bit word is assembled the channel will request an indirect data store to the IOM. If the read command is terminated before a 36-bit word is assembled, the word will be transmitted to the IOM and the character position of the last character in the word will be indicated in bits 0-2 of the request for status service word.

During the reading process the channel will not process any of the ignore characters. That is, only those characters that have a respective 6-bit code will be processed and packed into a 36-bit word for transmittal to the IOM. If the channel does not receive a character for a period of thirty seconds, the Read Command is to be terminated with a Data Alert, Operator Distracted status.

The Read Process will be continued until the channel receives an End of Message (EOM) from the console, a tally run-out is received from the IOM, or an exception condition is detected. If the continue bit is set in the PCW or IDCW and the Read Instruction is terminated due to an EOM from the console, the channel will terminate the Read operation with the console and continue list service without requesting status and interrupt service. If the continue bit is not set or the Read operation is terminated due to an exception condition, the channel will terminate the operation with the console, map the appropriate status and request a status service and level 3 interrupt service. The subsystem status that will be reported at termination of the Read Instruction will be one of the following:

| <u>Status</u>                                          | <u>Reason</u>                                                                          |
|--------------------------------------------------------|----------------------------------------------------------------------------------------|
| Channel Ready 90000)<br>No substatus (000000)          | Normal termination, no exception condition detected.                                   |
| Device Attention (0010)<br>No Substatus (000000)       | Console Ready Line, or console clocks, not activated, manual intervention required.    |
| Data Alert (0011)<br>Transfer Timing Error<br>(000001) | Data store request not granted before another character was received from the console. |
| Transmission Parity Alert<br>(0X0010)                  | Channel detected parity error in last transmission from console.                       |
| Operator Input Error<br>(000100)                       | Previous data input contains an error - disregard previous data.                       |



4.2.1

READ (03) (continued)

| <u>Status</u>                      | <u>Reason</u>                                    |
|------------------------------------|--------------------------------------------------|
| Message Length Alert<br>(100000)   | Tally run-out instead of expected EOM.           |
| Operator Distracted<br>(001000)    | Thirty second elapse without input from console. |
| Command Reject (0101)              |                                                  |
| Invalid Operation Code<br>(000001) | Console instruction is not recognizable.         |

4.2.2

WRITE (13)

If the PCW is acceptable the channel will verify that the console is ready. If the console is ready the channel will request list service for a DCW, or IDCW. If the control word is acceptable, the channel will request an indirect data load service. Upon receipt of the first data word the channel will activate the channel transmit line, signaling the console that data is to be transferred from the system. The console will respond with a character and bit sync. pulse. The channel, by this time will have processed the data from the IOM bus and waiting in the output buffer for transmission to the console. The data transfer to the console will continue until a fault condition is detected or a tally run-out is received from the IOM. If the channel receives the character timing pulses and does not have a character ready for transmission, an all zero character with parity will be sent to the console.

If the continue bit is set in the PCW or IDCW and the Write operation is terminated due to a tally runout, the channel will terminate the Write operation with the console and continue list service without requesting status and interrupt service. If the continue bit is not set or the Write operation is terminated due to an exception condition, the channel will terminate the operation with the console, map the appropriate status and request a status service and level 3 interrupt service. The subsystem status that will be reported at termination of the Write Instruction will be one of the following:

| <u>Status</u>                                    | <u>Reason</u>                                                                       |
|--------------------------------------------------|-------------------------------------------------------------------------------------|
| Channel Ready (0000)<br>No Substatus (000000)    | Normal termination, no exception condition detected.                                |
| Device Attention (0010)<br>No Substatus (000000) | Console Ready Line, or console clocks, not activated, manual intervention required. |
| Data Alert (0011)                                |                                                                                     |



## 4.2.2 WRITE (13) (continued)

| <u>Status</u>                         | <u>Reason</u>                                          |
|---------------------------------------|--------------------------------------------------------|
| Transmission Parity<br>Alert (0X0010) | Console detected parity error in<br>last transmission. |
| Incorrect Format (010000)             | Illegal sequence of characters in<br>data.             |
| Command Reject (0101)                 |                                                        |
| Invalid op. code (000001)             | Console instruction is not recognizable.               |

## 4.2.3 WRITE ALERT (51)

When the channel receives a PCW with a Write Alert Instruction, the channel will activate the Operator Attention Alarm Line to the console. It is to be noted that the execution of this command does not depend on a reflection of console Ready to the channel. The attention alarm line will remain set until reset by the operator. The channel, upon activating the Operator Attention Alarm will map the appropriate status, request status, and level 3 interrupt service. It is to be noted that terminating the Write Alert Instruction shall not turn the operator attention alarm off. The alarm being on shall not prevent any other command from being executed. The subsystem status reported as a result of a Write Alert termination will be one of the following:

| <u>Status</u>                                    | <u>Reason</u>                                                      |
|--------------------------------------------------|--------------------------------------------------------------------|
| Channel Ready (0000)<br>No Substatus (000000)    | Normal termination, no exception<br>condition detected.            |
| Device Attention (0010)<br>No substatus (000000) | Console Ready line not activated, manual<br>intervention required. |
| Command Reject (0101)                            |                                                                    |
| Invalid op. code (000001)                        | Console instruction is not recognizable.                           |

## 4.2.4 REQUEST STATUS (00)

When the channel receives a PCW with a Request Status Command, the channel will not request list service for a DCW. If the PCW is acceptable, and the console is ready the channel will request a status service and a level 3 interrupt service. If the console is not ready the channel will set the Device Attention status and then request status and interrupt service. The subsystem status reported as a result of a Request Status Instruction will be one of the following:

| <u>Status</u>                                 | <u>Reason</u>                                           |
|-----------------------------------------------|---------------------------------------------------------|
| Channel Ready (0000)<br>No Substatus (000000) | Normal termination, no exception<br>condition detected. |



**Honeywell**

Rev. A

Page 32

## 4.2.4 REQUEST STATUS (00) (continued)

| <u>Status</u>                                          | <u>Reason</u>                                                   |
|--------------------------------------------------------|-----------------------------------------------------------------|
| Device Attention (0010)<br>No Substatus (000000)       | Console Ready Line not activated, manual intervention required. |
| Data Alert (0011)<br>Transfer Timing Error<br>(000001) | No timing or sync. pulses, data out of sync.                    |
| Transmission Parity Alert<br>(0X0010)                  | Console detected parity error in last transmission.             |
| Operator Input Error<br>(000100)                       | Previous data input contains an error - disregard.              |
| Operator Distracted<br>(001000)                        | Operator failed to respond within 30 seconds.                   |
| Message Length Alert<br>(100000)                       | Tally run-out detected before EOM from console.                 |
| Incorrect Format<br>(010000)                           | Illegal sequence of characters in data.                         |
| Command Reject (0101)<br>Invalid op. code              | Console instruction is not recognizable.                        |

## 4.2.5 RESET STATUS (40)

When the channel receives a PCW with a Reset Status Instruction, the channel will not request a list service for a DCW. If the PCW is acceptable, the channel will verify that the console is ready. If the console is ready the channel will reset all Data Alert status contained in the subsystem status field of the channel status word and request a status and interrupt service. If the console is not ready the channel will map the Device Attention status and request a status and level 3 interrupt service. The subsystem status reported as a result of a Reset Status Instruction will be one of the following:

| <u>Status</u>                                      | <u>Reason</u>                                                   |
|----------------------------------------------------|-----------------------------------------------------------------|
| Channel Ready (0000)<br>No Substatus (000000)      | Normal termination, no exception condition detected.            |
| Device Attention (0010)<br>No Substatus (000000)   | Console ready line not activated, manual intervention required. |
| Command Reject (0101)<br>Invalid op. code (000001) | Console instruction is not recognizable.                        |



## 4.2.6

## ASCII WRITE (33)

The ASCII Write Instruction will permit the software to transfer data to the console in the 7-bit ASCII code without the normal data conversion processing. The execution and termination of this instruction will be the same as the normal Write Instruction except the 6-bit to 7-bit code conversion will not take place. This also means there will be no special characters or escape sequences recognized by the channel adapter when executing the ASCII Write Instruction. The subsystem status reported as a result of the ASCII Write Instruction will be one of the following:

| <u>Status</u>                                         | <u>Reason</u>                                                                       |
|-------------------------------------------------------|-------------------------------------------------------------------------------------|
| Channel Ready (0000)<br>No Substatus (000000)         | Normal termination, no exception condition detected.                                |
| Device Attention (0010)<br>No Substatus (000000)      | Console Ready Line, or console clocks, not activated, manual intervention required. |
| Data Alert (0011)                                     |                                                                                     |
| Transmission Parity                                   | Console detected parity error in last transmission.                                 |
| Command Reject (0101)<br>Invalid op. code<br>(000001) | Console instruction is not recognizable.                                            |

## 4.2.7

## T&amp;D READ (07)

The T&D Read Instruction will be provided to enable software to isolate a channel malfunction from the external subsystem.

During a Write operation, the data output is looped back and returned to the IOM interface buffer. This will make available to software the last 36-bit word of the Write operation after it has completed the required processing for transmittal to the console and returned via the channels read logic.

Alphanumeric data will appear in its original format and code. It is to be noted that only one word (last 36-bits of previous write) will be transferred to the operating system in response to a T&D READ Instruction.

Due to the processing and conversion of the escape sequences the data that will be available for a T&D Read following the various 6-bit escape sequences are listed below:

| <u>6-Bit Character<br/>Code Escape Sequence</u> | <u>6-Bit Character<br/>Code After Wraparound</u> |
|-------------------------------------------------|--------------------------------------------------|
| ! + ! + !                                       | 0 + 0 + !                                        |
| ! + ! + ?                                       | 0 + 0 + ?                                        |
| ! + ! + sp                                      | 0 + 0 + 40                                       |
| ! + 0XXXXX                                      | 0 + 12                                           |
| ! + 10xxxx                                      | 0 + 11                                           |



**Honeywell**

Rev. A

Page 34

## 4.2.7 T&amp;D READ (07) (continued)

No console communications take place for a T&D Read Instruction. The channel will request a data store service and transmit the contents of the IOM interface buffer. The channel will simulate an EOM signal from the console, and terminate the T&D Read Instruction following the 36-bit word transfer. The subsystem status that will be reported at termination of the T&D Read Instruction will be one of the following:

| <u>Status</u>                                      | <u>Reason</u>                                        |
|----------------------------------------------------|------------------------------------------------------|
| Channel Ready (0000)<br>No Substatus (000000)      | Normal termination, no exception condition detected. |
| Command Reject (0101)<br>Invalid op. code (000001) | Console instruction is not recognizable.             |

## 4.3. DATA TRANSFER

The channel shall be capable of transferring data to meet the demands of the console. This requires that the channel be capable of sustaining a burst rate of 960 characters per second. The "bit timing" on the console interface will be 9600 bits per second. The character timing will be 1/10 th the rate of the bit timing or 960 bits per second.

The control center and channel adapter will generate and check odd parity for each character transferred. The control center will acknowledge each character received with correct parity. Whenever the channel is transferring data to the console and the character or bit timing is missed the channel will transfer a null character with parity which will be ignored by the console. When the channel is receiving data from the console, a character sync. pulse will be transmitted by the console only when a data character is being transmitted.

The console channel adapter will be an indirect, single precision data channel. The data format will be interpreted by the channel as shown below. The 3-bit codes shown in the format identifies the character position within the word.

|     |     |       |       |       |       |    |
|-----|-----|-------|-------|-------|-------|----|
| 0   | 5 6 | 11 12 | 17 18 | 23 24 | 29 30 | 35 |
| 000 | 001 | 010   | 011   | 100   | 101   |    |



## 4.4 SPECIAL INTERRUPT (Operator Request)

Activation of the operator request button will result in a special interrupt being transmitted to the IOM Central. The action that is initiated by the channel when an Operator Request is received from the control center depends on the mode of the console and the channel.

1. If the console is not ready the operator attention indicator will be illuminated and audio alarm sounded on the console, no interrupt will be communicated to the IOM Central.
2. If a console read instruction is being executed the operator request line will be inhibited at the channel adapter.
3. If the console is ready and the channel is not processing a console Read Instruction, the channel will execute a level 7 interrupt to the IOM Central.

If the channel is not masked, or processing a console read instruction, the interrupt service for special interrupt will be requested immediately. The channel shall not declare itself busy in order to request a special interrupt service.

When a operator request is received, the channel will inhibit the request line and request the interrupt service. The channel will not enable the request line until a read instruction is received from the IOM Central.

## 4.5 STATUS

The channel adapter will maintain the subsystem status in bits 2-11 of the channel status word. The status will be reported at the termination of each instruction. It is to be noted that the status is not cleared following termination of an instruction, but is maintained until another instruction is received requiring a new status report.

Table 4.1 presents a summary of the possible status reports for each of the console instructions. The following paragraphs describes the major status and substatus to be reported in the subsystem status field of the channel status word.

4.5.1 Channel Ready (0000)

## No Substatus (000000)

This status indicates that the console is on-line and ready and no detectable exception conditions exist. When a command is terminated with this status it indicates that the command was successfully completed and the console is ready for another command execution.



## 4.5.2

Device Attention (0010)

## No Substatus (000000)

This status report indicates that the console is not ready and manual intervention is necessary. Conditions causing this report are: (1) console ready line not activated; (2) failure of the channel to receive character or bit timing pulses within 30 seconds after the channel enters the Read or Write mode.

## 4.5.3

Data Alert (0011)

## Transfer Timing Error (000001)

The Transfer Timing Error status will be reported whenever the channel is receiving data from the console and a seventh character is received before the channel is granted a data store service for the preceeding 6 characters.

## Transmission Parity Error (0X0010)

When a Write Instruction is terminated with a Parity Error Status report, the indication is that the data received by the console contained a parity in the last character received.

When the channel detects a parity error on data received from the console, the channel shall terminate the Read Instruction immediately and report the error status. The Read and Write commands are the only console instructions that can be terminated with parity errors.

## Operator Input Error (000100)

The Operator Input Error is manually initiated by the operator depressing the (OIE) button on the console control panel. When the OIE error is entered, the OIE line will be activated and detected by the channel. When the OIE line is activated the channel will inhibit the Read line, reset the data buffers, map the OIE status and request a status service. There will be no data store request made to the IOM following an OIE error. The read command is the only console command that can be terminated with an OIE status. The OIE line will be inhibited except when the clear to send line is activated.

## Operator Distracted (001000)

The Read command is the only console command that can be terminated with this status. The Read command is terminated with Operator Distracted if 30 seconds elapses before the first acceptable character is received following activation of the clear to send line, or 30 seconds elapses between characters during the data transfer. If a partial word has been assembled when the 30 second time has elapsed, the data buffer will be reset and the command terminated.



**Honeywell**Rev. *A*

Page 37

4.5.3

Data Alert (0011) (continued)Incorrect Format (0100X0)

An incorrect Format termination is caused by an unallowable sequence of control character(s) and regular characters. When a format error occurs the data transaction will be stopped and a status service request made of the IOM. The Incorrect Format status will occur only for a write command.

Message Length Alert (100000)

The message length alert will occur only for read instructions. The Message Length Alert status will occur when a Read Instruction is terminated as a result of a tally run-out, instead of the expected End-of-Message termination.

4.5.4

Command Reject (0101)Invalid Instruction Code (000001)

This status termination will occur whenever the channel is unable to recognize the console instruction code field in bits 0-5 of the PCW.



TABLE 4.1

PERMISSIBLE  
STATUS REPORTS

## STATUS CONDITIONS AND CODES

|                           | MAJOR<br>STATUS | SUB<br>STATUS | READ | WRITE | WRITE ALERT | REQUEST STATUS | RESET STATUS | ASCII WRITE | T&D READ |
|---------------------------|-----------------|---------------|------|-------|-------------|----------------|--------------|-------------|----------|
| CHANNEL READY             | 0000            |               |      |       |             |                |              |             |          |
| NO SUBSTATUS              |                 | 000000        | X    | X     | X           | X              | X            | X           | X        |
| DEVICE ATTENTION          | 0010            |               |      |       |             |                |              |             |          |
| NO SUBSTATUS              |                 | 000000        | X    | X     | X           | X              | X            |             |          |
| DATA ALERT                | 0011            |               |      |       |             |                |              |             |          |
| TRANSFER TIMING ERROR     |                 | 000001        | X    | X     |             | X              |              |             |          |
| TRANSMISSION PARITY ERROR |                 | 0x0010        | X    | X     |             | X              |              | X           |          |
| OPERATOR INPUT ERROR      |                 | 000100        | X    |       |             | X              |              |             |          |
| OPERATOR DISTRACTED       |                 | 001000        | X    |       |             | X              |              |             |          |
| INCORRECT FORMAT          |                 | 0100x0        |      | X     |             | X              |              |             |          |
| MESSAGE LENGTH ALERT      |                 | 100000        | X    |       |             | X              |              |             |          |
| COMMAND REJECT            | 0101            |               |      |       |             |                |              |             |          |
| INVALID INSTRUCTION CODE  |                 | 000001        | X    | X     | X           | X              | X            | X           | X        |

Honeywell

Rev. A

Page 38

43A232500



5.0

GENERAL DESIGN REQUIREMENTS

The channel shall conform to 43A177851, General Design Requirements for 655 and 355 systems, insofar as that specification applies to individual circuit boards.

6.0

RELIABILITY

The reliability of the console channel adapter shall be equivalent to similarly constructed integrated circuit, H-6000 technology, functional elements. Reliability testing will be conducted on a subsystem basis rather than on a functional basis, to verify that the system's minimum acceptable MTBF objectives have been reached.

6.1

MAINTAINABILITY

It shall be a design goal to provide diagnostic visibility into each major logic level of the channel adapter. The visibility shall be provided upon receipt of special commands issued by software. The special commands and their respective functions will be defined as hardware implementation plans progress.



**Honeywell**

Rev. A

Cont. on Page Final Page 40

TITLE: ENGINEERING PRODUCT SPECIFICATION, PART 1  
H-6000 CONSOLE CHANNEL ADAPTER

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System T&D Design

\* ASCII READ FUNCTION IS NOT PROVIDED  
ASCII WRITE FUNCTION IS PROVIDED. THEREFORE  
THIS IS NOT AN ASCII DEVICE.

UNIQUE with AI that read ASCII should be provided  
to make this a complete ASCII subsystem. S.F.  
w. third subsystem is incomplete.

Δ PRINTER ADDRESSING AND ASCII READ MODE (PER ABOVE NOTES  
MAY NOT BE AVAILABLE DUE TO SPACE LIMITATIONS. JHR 6/18/71